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VOL. XVIII MARCH, 1931 No. 3

EDITORIAL

By O. E. Servis

Past Supreme President and Chairman of Educational Session, Chicago Branch, January, 1931

From the interest displayed in our recent meeting of the A. E. S. and Heat Treaters Research Committees and the amount of good there is to be accomplished for the Plating Industry as a whole through the co-operation of both of these societies, we believe that these meetings should become a permanent institution at specific intervals.

We believe it would relieve many misunderstandings that now exist in the minds of the manufacturers and the public at large about the corrosive and erosive values of the different materials that are now in universal use and also relieve many cheap and ugly imitations of materials of merit, to the benefit of everyone—from manufacturer to consumer.

We also believe the time has arrived when many of our former customs must be modernized to meet the advance of progress being made through experience gained in the present economic depression. The usual objections to these advances must be laid aside and we must proceed with care but not autocracy to establish closer and better relations with all societies that are interested in making better basic materials for the electro-plater to work his art upon. The writer fully believes that now is the time to commence and incessantly strive to this end and hopes the next annual meeting will legislate so that this can be accomplished.

RED CROSS APPEAL

By F. J. Hanlon
Past President and Past Editor

At this time when our society is endeavoring to obtain funds with which to investigate problems that seem to delay progress of the electro-plating industry, it is well not to forget that a greater problem has hit our good old U. S. A. and many of our good citizens and families are suffering for shelter and food and after listening to the Red Cross hour on the radio, I believe that we as a society should ask our more fortunate and working members, to get back of the appeal of President Hoover, Messrs. Coolidge and Smith and Mesdames Belmont and Fairbanks, with all our heart and contribute at once to their local chapters of Red Cross.

It will be well to remember that this society of American origin should afford a little democracy, much American truthfulness, a lot of old-fashioned honesty of purpose, and plenty of thought for the welfare of its fellow citizens in want; do your bit now as a member of American Electro-Platers Society.

BUFFERING THE NICKEL SOLUTION

By Dr. Oliver P. Watts, University of Wis.
Hon. Member of Chicago Branch of the A. E. S.
Read at Chicago Branch Annual Meeting, January, 1931

Often in the past I have been asked to speak at the Annual Banquet on some phase of plating. This year the asking has been reversed, for at the last minute I asked your officers if I might have a place on your program in order that I might give to Chicago Branch the results of recent experiments in advance of the publication of the completed investigation.

Every plater knows by sad experience that the acidity of a cold nickel solution must be carefully controlled and its pH kept between the limits of 5 and 6, preferably about 5.8. If during plating the amount of metal dissolved from the anodes equals that deposited, the pH remains constant and all is well. If the current efficiency at the cathode exceeds that at the anode, due to passivity of the latter, i. e. if more metal is deposited than is dissolved, the acidity of the solution increases and its pH is lowered. If, on the other hand, due to a portion of the current being spent in depositing hydrogen, more metal is dissolved than is deposited, the pH rises and the solution tends to become alkaline.

To maintain the pH at a constant value either the efficiencies at anode and cathode must be equal, or the solution must be doctored at frequent intervals by addition of acid or alkali. The current efficiencies at anode and cathode are most easily kept equal when both are approximately 100 per cent. With a moderate current density and a pH of 5.8 to 6 this efficiency at the cathode is usually attained, and by increase of anode surface, addition of chloride, or both, the corrosion of some grades of nickel anodes may be raised to 100 per cent. As current efficiencies fall below 100 per cent it becomes increasingly difficult to keep the rates of corrosion and deposition equal, and doctoring of the solution with acid or alkali is usually necessary. When using sulphuric or hydrochloric acid to overcome alkalinity great care must be used that an excess is not added, else brittleness and peeling of the deposit results. There is no possibility of storing any excess of these acids in the solution as a guard against future production of alkali.

With boric acid, however, the case is quite different. 21 grams of boric acid and 49 grams of sulphuric acid are chemically equivalent, that is they are capable of neutralizing the same quantity of an alkali; but when they are added to a liter of water or of a nickel solution the results are very different. The sulphuric acid renders both the water and the nickel solution very acid, and practically stops the electro-deposition of nickel from the plating solution, hydrogen being deposited instead. The boric acid, however, produces no noticeable acidity and does not interfere with the deposition of nickel. This difference is due to the different degrees to which boric and sulphuric acid "dissociate."

All the acids, alkalies and salts which the plater uses undergo a process called ionization when they dissolve in water. A certain per cent of the total number of each kind of molecule dissociates or splits up into parts, oppositely charged electrically. These electrically-charged part-molecules, called ions, are what makes the solution an electrical conductor. One of the ions of acids is always hydrogen, and one ion of a metallic salt is the metal. In dilute solutions of "strong acids," like sulphuric or hydrochloric, most of the molecules are dissociated, the solution contains a great number of hydrogen ions, and the pH is low; but in solutions of weak acids, like boric and acetic, very few molecules are dissociated, the concentration of hydrogen ions is low, and the pH is much nearer that of pure water, which is 7, than in solutions of strong

acids. It is thus possible to give a nickel solution a large dose of boric acid without at the same time introducing so many hydrogen ions as to prevent good plating. The function of the 2 to 3 oz. of boric acid usually added to the nickel solution is to supply a reserve army which will attack and annihilate alkali as fast as it is produced by the current.

Neutralization by an alkali is not the only way to remove the harmful hydrogen ions that sulphuric acid makes in the nickel solution. To 500 cc. of nickel solution a little sulphuric acid was added and the pH fell to 1.4. The addition of 50 grams of sodium acetate, a neutral salt which has no power of "neutralizing" or destroying sulphuric acid, caused a rise in pH to 4.6, i. e. it diminished the hydrogen-ion concentration over a thousandfold, for a change of one unit in pH means a tenfold change in H-ion concentration. A robbery has taken place. The stronger sulphuric acid has broken up the sodium acetate and taken the sodium for its own, and left its hydrogen in exchange. There is now in the solution sodium sulphate and acetic acid instead of the original sulphuric acid and sodium acetate.

$$H_2SO_4 + 2\,Na(C_2H_3O_2) = Na_2SO_4 + 2\,H(C_2H_3O_2)$$

But acetic acid ionizes to a very slight degree, so that the pH is higher than before. Addition of the sodium acetate has greatly diminished the *intensity* of the acidity, i. e. lowered the H-ion concentration, but has not altered the *quantity* of acid. It has merely substituted acetic for sulphuric acid, and the same amount of alkali is required to neutralize the solution after the addition as before.

In another experiment 82 grams of sodium acetate were added to a liter of nickel plating solution, definite quantities of sulphuric acid added, and the pH determined calorimetrically. The results are given in the following table:

g. H_2SO_4	pH	g. H_2SO_4	pH
0	6.4	20	4.9
1	6.0	25	4.8
2	5.7	30	4.7
3	5.5	35	4.7
4	5.4	40	4.6
5	5.4	45	4.4
10	5.2	50	3.7
15	5.0	55	2.1

Without the sodium acetate the first addition of acid would have sent the pH below any value given in the table. A substance which thus stabilizes the pH of a solution against the addition of a strong acid or an alkali is called a "buffer."

The importance of a good buffer in the nickel solution is apparent at once. While it does not prevent the accumulation of acid when nickel is being deposited faster than it is dissolved, it substitutes a weak acid for the strong sulphuric acid, and so greatly lengthens the intervals at which the plater must destroy the acid by alkali or nickel carbonate.

Suppose that the total current on a nickel tank is 200 amperes, and that the efficiency of deposition is 95% and of corrosion of the anodes 70%. The difference, 25% of the total current, or 50 amperes, is manufacturing acid. If the solution is unbuffered 90 grams or almost 3 ounces of sulphuric acid is formed every hour. It is not surprising that nickel solutions need doctoring with chemicals frequently.

Thinking that other salts of weak acids might stabilize the acidity at different points or to different degrees than sodium acetate, sulphuric acid was added to solutions of the citrate, tartrate and phosphate (dibasic) of sodium, borax, boric acid and ammonium borate. Borax and boric acid have no practical value as buffers against sulphuric acid. The others act like sodium acetate and stabilize the pH at certain different values. Up to a concentration of 10 grams of sulphuric acid per liter a normal solution of sodium citrate holds the pH practically constant at 6.2. With increase of acid the pH falls gradually to 3.7 for a concentration of 40 grams of acid per liter.

Normal sodium tartrate gives a pH of 4.3 for 10 grams of acid, which falls gradually to 3.6 for 25 grams of acid per liter.

Disodium phosphate holds the pH near 7.5 up to 15 grams per liter of acid, and again stabilizes, but less effectively, around a pH of 6 up to about 25 grams of acid. A very strong solution of ammonium borate holds the pH above 6.5 up to 20 grams of acid per liter, and at 5.8 up to 45 grams of acid.

Of the various buffers so far tested the acetate seems more promising for the nickel solution under ordinary conditions of operation. This buffer may be added as sodium or nickel acetate, or acetic acid may be added when overcoming alkalinity until a sufficient quantity of acetate has been formed in the solution. Potassium or ammonium acetate might be used except that they

cause precipitation of double salts of nickel if the nickel content of the plating solution is high.

Buffering the nickel solution has two advantages:

(1) It permits the addition of sulphuric or hydrochloric acid in fairly liberal doses to guard the solution against alkalinity, for which purpose boric acid has been used in the past.

(2) It stabilizes the pH against the mineral acid formed by the electric current when anode corrosion is too low, which boric acid does not do.

The extent of buffering action varies with the concentration of the buffer, but for practical plating it is probable that much lower concentrations than used in these experiments will prove sufficient. Two to four ounces per gallon are suggested for sodium or nickel acetate.

At a definite difference between anode and cathode efficiencies the quantity of acid formed or destroyed is proportional to the total current; the use of a buffer will therefore be especially valuable in the hot nickel solution where very high current densities are employed.

For the facts on which this paper is based the writer is indebted to George E. Millard, senior in Chemical Engineering, University of Wisconsin.

CHAIRMAN SERVIS: Are there any questions you would like to ask Dr. Watts regarding this paper?

MR. MULLIGAN: Dr. Watts, do you always figure the same volume of solution for material to be plated on? Was there any thought given to increasing the volumes now carried in the electrolytic tanks in excess of what they carry now ordinarily in an effort to help controlling pH value? How much value would be derived by using a cubic foot and a half or a square foot and a half of snow deposit?

DR. WATTS: I do not think I get your point yet.

MR. MULLIGAN: You know our old plan. We have all our tanks with a solution. We circulate. We have excess in the circulation building for controlling pH factor. Could not this be applied here?

DR. WATTS: If you decrease your volume 50 per cent of what you are working, then you would not need to apply your medicine so frequently.

MR. MULLIGAN: It might be easier to control the increase of the volume.

DR. WATTS: Of course, the plater has all his solution in the tank. If he increases the volume of work he would have to increase it.

MR. MULLIGAN: Would it not do to have a reserve tank that would keep circulating from the volume he is using?

DR. WATTS: I think the platers will come around to the method the refiners have of continuously circulated or filtered solution.

MR. MULLIGAN: Our tanks are in operation twenty-four hours a day every day in the year; so we have to keep them right.

MR. GEHLING: What effect would that have on deposit? Would it denote any changes in the deposit?

DR. WATTS: I think that is about the effect that the change in pH would have; that is, with a higher pH you would have a softer deposit at the same temperature than you would at the lower pH. You notice the low pH solutions have to run pretty warm; otherwise they will be so brittle they will brick. If you run cold solutions you cannot let the pH fall the way they do in these hot solutions; so in a cold solution this is going to help to keep you from getting into brittle deposits.

MR. G. DUBPERNELL (Detroit, Mich.): I wonder if you can tell us anything of the stability of the acetate in the solution; that is, is there any instability? I think under some conditions acetate ion can be broken down and oxidized at the anodes.

DR. WATTS: It could not very well be broken down at the anode unless your anode is pretty insoluble. These oxidation effects of anodes are produced in insoluble anodes where oxygen is evolved. If your oxygen is running at 95 per cent efficiency, you have only 5 per cent of a current that can possibly do any oxidation of that anode, whether the hydrogen and cathode could do anything in the running or the low pH. You have a good deal of hydrogen in your cathode. I would not anticipate a serious trouble in a nickel solution.

MR. DUBPERNELL: I thought of it because I thought you mentioned 75 per cent efficiency.

DR. WATTS: I was quoting that as an example. Sometimes in your anodes you might get that if your low content was not right. Under those conditions you might get some destruction.

MR. DUBPERNELL: It might be entirely stable in these solutions. Maybe it is an alkaline solution in which the acetate ion is more easily oxidized even at an insoluble element.

DR. WATTS: I believe it would be oxidized at an insoluble element.

MR. HAY: Dr. Watts, is it possible to operate a nickel acetate solution in itself without any sulphate?

DR. WATTS: I cannot answer that question. I think I would not recommend it. I would rather see the sulphate solution with perhaps two or three ounces per gallon of acetate than to run a straight acetate solution.

MR. HAY: I came upon a little experiment along that line, and I could not find the right buffer agent to control that solution. In other words, what I was trying to do was to copper and nickel plate in the same solution.

MR. WATTS: That is, you were trying to deposit copper nickel alloy?

MR. HAY: No, copper plate first and nickel after.

DR. WATTS: That could be done by changing your current density.

DR. BLUM: I am sorry that Mr. Phillips left today so that he could not give this information first-hand. This question Mr. Hay asked was answered by Mr. Phillips in the convention at Washington when he was talking about the low pH solutions. The question was asked about whether boric acid has any value for buffing in a solution with a low pH as two or three. He pointed out in the discussion that in their research work in connection with low pH solutions, they had found that acetic acid solutions, including those made up entirely from nickel acetate, were far superior to any other baths or compositions that they had tried, but that the difficulty that was holding them back was, first, the expense of nickel acetate and, secondly, the fact that it does corrode lead and other pipes that would be used for conveyors. So I just point out that the experience of Dr. Watts is exactly parallel with that of Mr. Phillips in showing that particularly at low pH, where boric acid is not effective, acetic acid is very effective as a buffing agent.

MR. CLINDININ: I should like to take issue on the boric acid.

DR. BLUM: I am simply quoting, as best I can, Mr. Phillips.

MR. CLINDININ: I agree with our friend from Columbia University. We had better not think of cutting out the boric acid until we find out more about it. We have found that our buffing costs go skyward in a hurry if we cut down on our boric acid. I am not say-

ing what boric acid has to do other than act as a buffer, but it certainly does something else. In fact, we are carrying a higher boric acid content at the present time in the finer nickels than we did with a higher pH. We have to do it.

PRODUCTION NICKEL PLATING AT LOW pH

By C. E. Clindinin
General Spring & Bumper Corp., Chicago, Illinois
Read at Chicago Branch Annual Meeting, January, 1931

The subject of this paper is "The Operation of Nickel Plating Solutions at low pH." Its purpose is to give those interested in the plating industry the advantage of our experience along this line.

I wish to take this opportunity to acknowledge the work of Messrs. Mougey and Phillips as first set forth in the paper presented by the latter before the Washington 1930 convention of the American Electro-chemical Society. Our findings are in agreement with theirs in almost every detail.

About three years ago the writer entered the employ of the C. G. Spring and Bumper Company and at that time they had been operating on a pH range of 3.5 to 5 and preferably 3.5 to 4.2 for three to four years. This is a decided contrast to the almost universal practice of other plants operating between pH 5.4 and 6.2.

This plant has enjoyed years of production of a product of high salt spray resistance, and we attribute it largely to the above practice. On several occasions previous to 1930 we discovered, through routine analyses, that some solutions had a pH as low as 3 and no evidence of pitting. To state it plainly the only times that we have operated above 4.5 have been to cure gas pitting, which since that time we have realized was due largely to impure solutions; a result of occasional poor filtering.

It is hardly possible to lay too much emphasis on care of filtering, as will be pointed out in a later part of this paper. We have a battery of two presses and two pumps, each capable of forty to fifty pounds pressure. Our solutions are filtered through specially woven cloth at high pressure, and because they have first been neutralized the effluent is quite free from dissolved impurities, as well as clear and sparkling.

Better buffing and color were experienced whenever we approached the low limit of pH as set down in our standard practices,

so it was inevitable that, when we had assured ourselves that the salt spray resistance of our product was increased when our solutions were operated slightly above pH3, we needed but little encouragement to increase the acidity of our plating baths to a new low pH of 2.2—2.4.

Each individual plating plant must decide what pH is best suited for their own operating conditions. We chose the above stated range because at that acidity and the current densities and temperatures favored by us sufficient hydrogen is evolved to dislodge any foreign particles on the cathode without seriously reducing the cathode efficiency.

The question of what pH is best suited for your plant must be considered from several angles, such as:

What is your ratio of plating tanks to generator capacity?

What is the shape of the article to be plated and what is the consequent dragout?

How efficient is your filtering equipment?

The cathode efficiency drops quite rapidly below pH2, and unless one has a proportionately large generator capacity they will not be able to plate the usual thickness on the same number of pieces per hour as required. While it is true that a thinner plate at low pH is superior to one at high pH, even so there is a limit to which it can be carried. However, if the pieces to be plated are of such shape as to cause a heavy dragout and you do not have good filtering facilities, a lower pH is to be recommended even if another generator is required to obtain higher current densities and thus secure the required amount of plate in a specified time.

An appreciation of the variation in cathode efficiency can be gained from the following reactions:

$$\begin{array}{cccc} = & ++ & = & \\ H_2SO_4 = SO_4 + HH = & SO_4 + H_2 & \text{gas evolved} & \\ = & ++ & = & \\ NiSO_4 = SO_4 - Ni = & SO_4 + Ni & \text{(plated)} & \end{array}$$

In the second reaction the nickel ion is plated out and the SO_4 ion combines with another nickel ion from the anode, and this maintains a balance. But in the first reaction instead of nickel being plated on the cathode hydrogen gas is liberated. The sulphate ion thus set free also combines with nickel, thus building up the nickel content of the bath. However, as can be readily seen, if too much

acid is present a large amount of gas will be evolved, thus decreasing the amount of nickel plated by a given quantity of current.

Low pH solutions are clear and brilliant and, inasmuch as most impurities in nickel anodes are soluble in solutions of the above acidity, it is essential that anodes of high purity be used, thus maintaining a plating bath of relatively low and constant foreign mineral content. Iron present in small amounts probably tends to improve the quality of the nickel plate because of the smaller crystalline structure of alloy plate. This is in direct contrast to semi-colloidal iron present in solutions of high pH, which is a probable cause of considerable pitting.

Plating operations conducted at a low pH and the consequent lowering of nickel sulphate addition requirements due to the building up of nickel content from the anodes have several advantages:

1. It is a price saving because nickel as anode is cheaper than from nickel sulphate.
2. It is easier to obtain anodes of a given high purity than is the case with nickel salts.
3. The cost of handling is lower. The proper preparation of nickel sulphate is much more expensive than placing anodes in place. It is our practice to dissolve the nickel salts in a spare tank, neutralize the solution and filter into a clean storage tank. This solution is quite free from impurities and is added to the various plating baths as required. After one has succeeded in purifying his plating baths it is certainly unwise to make additions that are not correspondingly pure.

Anyone contemplating the adoption of low pH plating must plan on the exercising of strict supervision and care of their plating department and a close check of the work on the buff. Rather large quantities of sulphuric acid will be required to lower the pH. One half pint of 66° sulphuric acid will lower 100 gals. of our solution one pH. The above figure will vary somewhat with different solutions. Permit the writer to emphasize that the purer the solution and the less the residue, just so will the plater experience fewer difficulties during the period he is lowering the pH. If the plating baths are not free from undissolved impurities the plater may find it necessary to add large quantities of hydrogen peroxide to stop pitting, the quantity depending upon the purity of his solutions.

Solutions operated at a pH of 2 to 2.5 are very flexible as to current density and temperature. A Watt's solution at 100° F. can be operated at 50 amperes per sq. ft. with excellent results, and 30 amperes per sq. ft. at 160° produces like products. The flexibility of the low pH nickel bath makes it of inestimable value to the plating industry, and this should be particularly true for the plating of irregularly shaped work.

The use of high current densities makes it possible to obtain greater production with present equipment. In some cases the addition of generators will double the capacity of the plant.

The plate appears to be finer grained and of better color and fully adherent, as is indicated by the small amount of peeled nickel when chrome plate is applied. Pitted and burnt nickel are almost unheard of after a constant pH has been established. The first loads run after the solutions have been idle for a week will come through in perfect condition.

Doubtless you are all familiar with the dire results experienced when your solutions are stirred, whether necessarily or accidentally. High speed production plants operating twenty-four hours a day must necessarily make large additions to their plating solutions with a minimum loss of time. Low pH solutions require less additions and very little time for settling because of absence of suspended particles due to the solubility of impurities in low pH solutions.

As soon as one becomes familiar with the behavior of low pH solutions they are much more easily operated than the more neutral ones. Standard daily additions of acid can be established based on the amount of work plated. The writer recommends a daily check of the pH of all solutions in order to procure work of consistent good quality.

Since our adoption of low pH solutions, the salt spray resistance of our product has increased materially. It should be the desire of every plater to produce the best work possible. In fact, if the plating industry is going to survive in the face of present competition, all who are interested in the art must exert every effort to produce a product of such quality as to meet the complete satisfaction and demands of the consumer, or, in other words, the American public.

Mr. C. E. Clindinin (General Spring and Bumper Corporation, Chicago, Ill.) : I might say following along the previous announcement that this is a footnote to the footnote. I tried to make it brief and to the point. I could have written enough to keep me talking here for several hours, providing I was not thrown out. I did not

want to do that. I want to bring out a few points, and then if there are any questions or any other points I will be glad to do what I can toward answering them, unless we get into some of the few points that I cannot answer. Of course, because of the corporation, I have to hold back a little bit. There are quite a few points up at the present time in the plating game and some infringements, and we do not say much about the way we do it.

I did not put down a figure there of salt spray and how much it has improved, but it is around 200 per cent. We have procured a salt spray cabinet, similar to the one used in the Ford plant, of cast Monel metal and porcelain; and we get tired of having some of the pieces in there. Of course we put pieces in every day for test during production; but at different times we have put in a set of pieces, and it has required from 288 to 300 hours to bring down the three pieces of a group. We do not leave anything less than 228 hours, and the longest time for letting pieces remain in there and still stay in good condition is 360 hours. That is quite a little different from what one can experience with the high pH heretofore. (Applause.)

CHAIRMAN SERVIS: Gentlemen, this is a very interesting paper. Are there any questions?

MR. GEORGE GEHLING: Of course, as you say, you have been running only three or four months; and you really have not had much time to find out what effect this high pH has on the tarnishing of the finished product after it reaches the market.

We had a discussion in the Research Committee yesterday. One of the men had made tests in reference to low pH and high pH and intermediate pH, and he found a hardness of the nickel, which really keeps the nickel from tarnishing (we used the word "tarnish" in place of "oxidization" because we seem to understand that word a good deal better than we do the word "oxidization"). He also found that the nickel plated in his plant with a pH of from 5.6 to 5.8 did not tarnish as readily as any deposit put on that commodity, whether he plated it with a pH of from 1.2 to 5.6 or whether he plated it from 5.8 to 6.2.

In a lot of the plating that we do on material that goes out to the public that is used on household goods, and so forth, it is very important to us to know how that tarnish is going to stand up when a person has it in a shop, in a store, or in a home. Have you people had any experience to show how readily it will tarnish with the low pH plating solution as compared with plating between 5.6 and 5.8?

MR. CLINDININ: We have had plenty of experience in the line of production. Previous to our adoption of the low pH it was necessary that we always run our work through the chrome line and then buff at the end of the day. Now it does not make any difference. We run the buffers from the full production up to closing time, and the buffed work can stand over and we can run it through the chrome line without any difficulty whatever. It does not start to tarnish, and at the previous high pH at which we ran it did.

I have nothing to say around 6.2; but I will say that with a pH at 5.4, at which we ran the tank, it was absolutely impossible to plate those satisfactorily in chrome if we let them stand overnight. This present nickel can stand for two weeks as it comes out of the plating line and then be buffed without any trouble; in fact, it buffs with about half the effort that our former nickel did just off the line, taking it hot. It has reduced buffing cost beyond all expectations, but to do that you will have to get a buffing compound suitable to low pH nickel. We had plenty of trouble going through it, but we feel that we have it pretty well ironed out after six months.

MR. F. C. MESLE (Oneida Community, Ltd., Sherrill, New York): I should like to ask whether that has been applied to all different kinds of metals, such as brass and steel?

MR. CLINDININ: I could not say, because our work is just on steel.

MR. MESLE: I should like to ask whether the improvement you get in resistance against corrosion is due to the low pH or to the fact that you are using a high current density and therefore a thicker deposit?

MR. CLINDININ: We are not using a higher current density.

MR. MESLE: What would be the result if you were using a current density around 50?

MR. CLINDININ: We run around 40 and 45 and have been doing so for nearly two years. We have not increased our current densities, because our production did not warrant it. We go into these things gradually, and we have to be sure of ourselves at all times. It has not been necessary to increase our current densities, and so we have not. I have run sample loads at a high pH for a very short time, and the results are certainly gratifying; but in every turn and in every way the low pH has the high pH backed off the map. We have not been able to find a point of argument in the plant favoring the high pH, but that we find two or three in favor of the low pH.

We are very enthusiastic over it. As a matter of fact, you can operate your low pH solutions without over 10 per cent of the effort required for the other and with very little supervision. The only thing is to set down your standards and have them positive for certain times, and you can forget them for the rest of the time.

MR. WARNER: I should like to ask whether the spraying test of 360 hours you made was on nickel or chromium?

MR. CLINDININ: On chrome.

MR. WARNER: I thought nickel would not stand up.

MR. CLINDININ: Certainly not. I have seen nickel at a high pH when you could almost see it rust. Of course, that is not always true.

Another thing of interest is in filtering. It was our custom previously, before adopting the low pH, to filter all of our solutions every week. That was considerably over 10,000 gallons. It was rather burdensome. Now we do not filter. I had occasion to empty a tank yesterday morning due to a leak in the tank. There was no residue in the tank, except a little carbon, because of the type of anodes we use; but everything else dissolved. Formerly we had (what was spoken about this morning, I believe, by Mr. Proctor) from 12 to 15 inches of sludge in the bottom of the tanks in one line. If the tanks were deep enough we could get by with it.

MR. L. W. HOPKINS: I should like to ask whether you have had any trouble with corrosion in the handling of equipment, due to low pH?

MR. CLINDININ: No. As I say, we are running with a pH of 2.2 or 2.4; and at that pH I would say that we use both lead-lined and rubber-lined tanks—hard rubber in one and lead line in the other—and a pH of 2.2 will not have the action on lead that a pH around 6.4 or 6.5 would have.

MR. R. P. LOPEZ (Hickak Manufacturing Company, Rochester, N. Y.): I should like to ask whether you have increased the design of plate? In other words, you have not changed your current density, or you have not changed your time of plating from the low pH to the high pH.

MR. CLINDININ: We are running now at our regular standard setting.

MR. LOPEZ: With the same current density?

MR. CLINDININ: The same current density has been in force for

the last two years, but with a greater production. Of course, I have run special loads for metal work right along with our metal production. I have run high and low temperatures, and on two occasions we have had very high temperatures. We did not want to shut down. There was a leak in the coil, and we could not run water through the cooling coils. The tank was adjacent to a hot cleaner; and we just kept on, and the temperature kept rising and got up to 107. Of course, I took test pieces at that time from the salt spray load. I never lose an opportunity to make tests whenever an accident of that kind happens.

MR. LOPEZ: Have you noticed any difference in the thickness?

MR. CLINDININ: Our cathode efficiency is only slight at that pH. If I drop the pH down from 1.7 to 1.8, which I have done, it is almost like a geyser. The whole solution bubbles up with gas. If I lower that much we get buffed through. Of course, we have the alternate plates and the top nickel to buff through the tops. We have to lower the cathode efficiency unless we increase our time and cathode cycle, which we do not want to do. Everything is run the same as previously, with the exception of the pH.

CHAIRMAN SERVIS: What are your limitations on pH?

MR. CLINDININ: I have chosen to set them at 2.2 and 2.4. They do not change. I do not know what would be the case if we ran at 1.5 and 1.2. The pH might change rapidly. But in a 2400-gallon tank, running nine hours, that means putting in 100 square feet of work every six minutes; and it takes about a quart of sulphuric acid to hold the pH. So the change is not so very rapid.

MR. F. F. OPLINGER: What liner do you find best for the tank, and if you use lead does it make it porous anyway?

MR. CLINDININ: We use lead in one of our plating lines—wood tanks, lead line—with no difficulty. We had occasion to examine one of the tanks yesterday. The tank developed a leak where we had built up the tanks on that line to get greater production. It was just poor workmanship on that job. It was merely splicing of the lead that had given away at a small point, not due to the low pH, but due to the fact that the lead on the top strip over the tank was supporting the lead below, and it just pulled away. In our larger lines, 2400-gallon tanks, we have hard rubber-lined steel tanks; and we have had no trouble.

MR. OPLINGER: Pure lead or alloy?

MR. CLINDININ: So-called chemical pure lead.

MR. F. C. NIXON: Mr. Chairman, I should like to ask if I am correct in believing that two years ago you were using a solution of around 3 and 3½?

MR. CLINDININ: From 3½ to 4½, preferably around 4.2.

MR. NIXON: Ordinarily speaking, that would be a low pH also.

MR. CLINDININ: That is considered low pH in the general trade.

MR. NIXON: I should also like to ask where you maintain the nickel content?

MR. CLINDININ: The regular Watts' formula—32 ounces per gallon of zinc salts—but we do not hold necessarily to that, as it rises. We do not care whether it is 32 or 40.

MR. NIXON: That is the point. Ordinarily, we make up a solution like that, but quite frequently we maintain it at a lower level.

MR. CLINDININ: Lower?

MR. NIXON: Yes.

MR. CLINDININ: No, I would run nickel up to 40 and keep the nickel chloride and boric acid at about 3 ounces.

MR. JACOB HAY: I should like to ask if the low pH would be just as good on brass as it is in this case?

MR. CLINDININ: We have not worked on that. We want to, but we have several other problems that we are battling.

MR. HAY: How is your throwing power?

MR. CLINDININ: Very good.

MR. HAY: Suppose you had a distance of 7 inches or as high as 11 inches, would you recommend a solution for that purpose?

MR. CLINDININ: Do you mean recessed? I don't know.

MR. HAY: I want to bring out one point. I do not know whether or not it is going to do any good. Suppose this could be 11 inches here. I found it was necessary to bring these articles running along the line which were the same at this point. Suppose this is the chain of travel and this the line of articles above, we found that here and here and here there was a difference on all these three points as far as the thickness of deposit was concerned. You could get as high as .0006 here, but it was necessary to furnish .0003 in the middle. After we had .0003 here we would have approximately .0005 here, .0006 here, and sometimes .0002 here.

MR. CLINDININ: How far were your anodes from the work?

MR. HAY: In every case we tried to be as nearly right as possible—6 inches.

MR. CLINDININ: You get a variation between your current density over the various parts of your pieces, in proportion to the distance of the anode. Inversely, we will say, with your anodes close to your work you get a greater variation with the current density over your work; farther away, less.

MR. HAY: After we added sodium sulphate we cut this point down to .0004, and this was the hardest point on which we had to put any metal; and we brought this to .0035 and we could not prevent this; but we always got .0005 over there.

MR. CLINDININ: Of course, it depends on what specifications you are furnishing in your product. If you have to meet salt spray (and that is the big point with us), you just have to be careful what you add. There are plenty of things to be added to increase the throwing power, but you cannot always do that.

MR. GRUND: What resistance for corrosion in coating is now being used under the nickel, applying nickel directly to steel?

MR. CLINDININ: We are using just a light strike of cyanide copper, primarily.

CHAIRMAN SERVIS: Is that a copper and cleaner?

MR. CLINDININ: Just a light strike of cyanide copper, primarily to clean the steel after the acid dip.

CHAIRMAN SERVIS: You don't acid copper at all?

MR. CLINDININ: We use the acid copper. We don't put enough cyanide copper following an acid copper.

MR. GEHLING: In the talk that we hear about the low pH, which is a high pH, the fact has been stressed in regard to buffing solution to get rid of sludge. When you use a high pH your tank builds up rapidly with sludge, and it has to be cleaned very frequently. In using the low pH you have no sludge. The question arises: What was the sludge? What becomes of it? Are you plating it in with the nickel? We were told that the sludge was nothing more than carbon and iron, and so forth, and that it went to the bottom of the tank. One of our previous speakers here stated that you could get rid of it then by dropping them through the bottom of the tank and cleaning that away. The question in my mind arises: What becomes of the sludges in the nickel now?

MR. CLINDININ: It dissolves in the low pH.

MR. GEHLING: It still stays there.

MR. CLINDININ: No, we plate it out.

MR. GEHLING: The carbon and everything else goes right into the plating.

MR. CLINDININ: The carbon will not. I stated that it will all be found at the bottom of the tank. We know the carbon is not active at such a temperature as that. I know there has been a lot of worry as to what would happen to the salt spray if we plated these various securities on the work, but a nickel anode does not rust very much when you let it lie around; so why should the same rust plated on your article? The same thing is true if you lower your pH enough so your local salt conditions are reduced to a minimum and putting the nickel anode on the work will not rust.

DR. WM. BLUM: Mr. Chairman, I should like to confirm the impression I got, because I think it might not be clear to all. If I got the right impression, you are plating cyanide copper, nickel, acid copper, nickel, and chromium. In other words, you are putting on five layers of metal. I think we ought to have that clear in connection with the salt spray resistance.

The other point is that I want to ask this question: You did make a slight reference to pitting, and I know in Mr. Phillips' discussion he said that pitting was much more pronounced with a new solution at first, and that at first it was necessary to use hydrogen peroxide. Do you find that necessary?

MR. CLINDININ: There is one thing I will have to say. I was very cautious in starting on this low pH. Yesterday the tank leaked and I had to empty it and put in another solution; but I added sufficient acid to bring the pH down to where we wanted it (I am not saying what else we added), and started right off without any trouble whatever. From then on I do not worry about it. We just simply lower the pH and start right off.

MR. STOCKTON: When I heard about this lecture two or three days ago, there were two or three questions that came to my mind which I should like to ask if it does not take too much time. One is whether there is a relation between the most favorable temperature of operation and the pH in the low pH range. Suppose you were operating at 2.2 at a certain temperature and the pH lowered to 1 or 1½. Should the temperature be changed? Should it be raised, for example?

MR. CLINDININ: I would not say to raise the temperature. It

might be possible. You get better buffing at a temperature of around 120, a current density of 40, and a pH as we are running, 2.2 to 2.4. To increase your temperature it is a little harder to buff, but whether or not it is entirely due to the change of temperature we cannot say to date. We are following those things through and are getting more information from day to day.

MR. STOCKTON: Another question I have been very much interested in is the relation between suspended matter of any and all kinds to the quality of the work and the smoothness of the work. That question I have divided into two parts: A, for example, the kind of suspended matter, whether it is metallic nickel, carbon, or dirt in general; and B, the size of the particle—what does the size of the particle have to do with it, and what is the lowest limit of size permitted?

MR. CLINDININ: Suppose we take the cart before the horse and answer the second question, the size of the particle. If the particle is colloidal, of course even then it is large compared with the plating from the solution, that is, the size of the atom, and you are bound to get into porosity; and the larger the size of the particle, the more porosity.

MR. CHARLES H. PROCTOR (New York): Point of information. I should like to inquire what is the total expired time of plating on the five deposits?

MR. CLINDININ: The entire time of plating is six minutes in each tank.

MR. PROCTOR: That means thirty minutes.

MR. CLINDININ: Thirty minutes for a plate.

MR. PROCTOR: It is possible to plate three coatings in a total of twenty-three minutes and get a salt spray test in 450 hours without using low pH solution.

MR. CLINDININ: We used to get 150 to 200 hours salt spray in the cabinet formerly used, but when we got this new one we did not; that is where we found we were in error.

MR. PROCTOR: As a point of information for all concerned, we are depositing nickel first on bumpers in a solution containing 50 ounces of single nickel salts, 4 ounces of nickel chloride, and 1 ounce of cyanide potassium. We keep the pH not so low as 2 but close to 4. The total time of nickel, copper, and copper cyanide solution for a nickel deposit and chromium deposit is a total of twenty-three minutes, and we can get 450 hours out of four straight.

MR. CLINDININ: I can more than beat that. I have run special loads sixteen minutes—copper and nickel one minute and one-half in the chrome—let them stand (in the run at the present time we have some pieces that have been in 144 hours and are in almost perfect condition); but, as I say, our production is not such as to warrant us to cut any of our times or anything of that kind until we are absolutely positive that we are getting an A-No. 1 product.

MR. STOCKTON: Was there some special reason for raising the pH before filtering, or can you filter sufficiently well by leaving the pH alone?

MR. CLINDININ: You have to neutralize your solution; otherwise you do not precipitate your impurities.

MR. STOCKTON: I meant with regard to the sediment.

MR. CLINDININ: You will get more of it. You can filter if your solution is cloudy. If you have a low pH you do not have a cloudy solution. It is just as clear and sparkling from the solution level at the top almost to the bottom of the tank until we get into our carbon.

MR. STOCKTON: Which is worse, little metallic particles or pieces of carbon, or dirt in general in damaging the work?

MR. CLINDININ: Carbon is inactive and will not cause trouble, but organic matter will cause pitting. That localizes the hydrogen on some spot of the work; and you do not get any metal plated there, and you get a large pit.

MR. L. A. DAVIES (Detroit, Mich.): After your solutions are in working order, in other words, in operation, do you make any additions of nickel sulphate; or, in other words, do you take all the nickel from your anodes?

MR. CLINDININ: We are making small additions of nickel sulphate. We have not gone to the point in low pH where we have reduced our cathode sufficiently to get enough nickel from the anodes to take care of the plate and the drawing out. However, we add nickel as a pure filtered solution. We make up the regular Watts' bath and keep that in our storage tank. It has all been dissolved, of course, neutralized, filtered, and ready for use. Of course, all we have to add to that solution is enough to take care of evaporation; and, of course, the drawing out keeps it in shape.

MR. DAVIES: Don't you run into pitting every so often?

MR. CLINDININ: No. Pitting is completely washed out of the picture. We have not seen a nickel pit in five months.

CHAIRMAN SERVIS: What about evaporation?

MR. CLINDININ: In a tank of 42-inch depth we have an evaporation of about 3 inches in that tank. We get some drawing out and an evaporation of about 3 inches in a nine-hour run.

MR. DAVIES: Can you use the low pH bath to plate directly on steel, or do you have to put your cyanide on first?

MR. CLINDININ: You can plate directly on steel. The only object in using cyanide strike is just to have a little cleaner base for the nickel. There is a satisfaction there. It does give you a better color. You can put on a low current density and a bright deposit of cyanide copper with a nice foundation there for color. When you buff up that work it certainly looks nice. I will admit the cost is high.

SUMMARY

Conference on Exposure Tests of Electroplated Metals. Held Under the Auspices of the Chicago Branch and Research Committee of the American Electroplaters' Society

Dr. William Blum, Bureau of Standards

On January 16, 1931, a meeting was held in Chicago, at which about fifty persons were present including the Officers and Research Committee of the American Electroplaters' Society, members of Committees A-5 and B-3 of the American Society for Testing Materials, and representatives of manufacturers interested in electroplating materials, processes and products.

The principal subject discussed was an outline for exposure tests of specimens to be prepared at the Bureau of Standards by P. W. C. Strausser, Research Associate of the American Electroplaters' Society, and exposed at the locations maintained by the A. S. T. M. in different parts of the country.

The principal recommendations of the conference were as follows:

1—The initial tests should include steel samples plated with zinc, cadmium, copper, nickel, or chromium, or combinations of such coatings. This course will make it possible to obtain direct comparisons of the value of these coatings for protecting steel against atmospheric corrosion. Subsequent tests will include coatings on non-ferrous metals.

2—In the preparation of such samples, only solutions of known and published composition will be employed, and no reference will be made in the reports to any patents.

3—Additional specimens will be prepared at the same time for use in laboratory studies upon methods of stripping, and upon accelerated corrosion tests, in order to determine whether there is any correlation between the results of laboratory and exposure tests.

Numerous details of the tests and methods of inspection were discussed. The program will be revised in the light of these suggestions and efforts will be made to prepare and expose the samples as soon as possible.

At a meeting of the Officers and Research Committee on January 18, it was decided that the representatives of the Electroplaters' Society on the special committee to make inspections of the plated coatings will be J. Hay, Chairman of the Research Committee, P. Sievering, Secretary and A. K. Graham. The A. S. T. M. is represented on this inspection committee by W. Blum, W. M. Phillips, and one other member to be appointed.

SUMMARY

Conference on Standards and Specifications for Electroplating

On January 17, 1931, a meeting was held in Chicago at which most of the same persons were present as at the conference on January 16.

There was a general discussion of the need for specifications for (a) materials used in plating and (b) plated products; and of the principles to be used in the preparation of such specifications. These principles were illustrated by reference to existing specifications of the Federal Specification Board and various technical societies. It was agreed that the Electroplaters' Society would render a distinct service to both manufacturers and users by preparing and adopting suitable standards, and co-operating wherever feasible with other organizations interested in this field.

No attempt was made in this conference to decide upon the details of any standards. At a meeting of the Officers and Research Committee of the American Electroplaters' Society on January 18, it was decided to form two sub-committees to prepare such standards. C. F. Nixon, of the Ternstedt Manufacturing Co., was appointed chairman of the committee on standards for plating materials, and H. S. Lukens of the University of Pennsylvania was made chairman of a committee on standards for electroplated products.

RESEARCHES ON SILVER PLATING

By E. B. Sanigar

Washington Convention, 1930

(Before commencing to read his paper, Dr. Sanigar expressed his appreciation for the Society's kindness to him since his arrival in this country from England.)

The fact that relatively little research work on silver plating has been done may be traced to the absence of any inherent difficulty in securing suitable deposits of silver from the double cyanide solution. This solution is the only one used for silver plating and, with very different conditions of temperature, solution composition and current density, gives deposits which can be easily polished. Whilst the silver bath is easy to work and easy to control, the chemical equilibria in the solution must be quite complex, and no complete theory explaining the deposition of silver from the double cyanide solution has yet been put forward.

The Theory of Silver Deposition:

Much interest has centered around the actual mechanism of the deposition of metals from double cyanide solutions, and two main theories have been proposed to explain the deposition of silver from such solutions. Both depend on the primary ionization—

$$KAg(CN)_2 = K^+ + Ag(CN)_2^- \qquad (1)$$

The older theory assumed that no further ionization occurred, and that the potassium ions were deposited, the liberated potassium metal reacting with the argentocyanide ions to give a deposit of silver:

$$K + Ag(CN)_2^- = Ag + K^+ + 2CN^- \qquad (2)$$

In support of this theory it was urged that since the deposition of silver was a secondary process there was no chance for the silver crystals to grow, so that the well-known, fine-structured deposits were given.

The more recent theory is that after the primary ionization shown in equation (1) takes place, a secondary ionization occurs:

$$Ag(CN)_2^- = Ag^+ + 2CN^- \qquad (3)$$

leading to the presence of free silver ions in the double cyanide

solution. In 1924 the writer used the Heyrovsky Polarograph, in conjunction with the dropping mercury cathode (Rec. Trav. Chim. des Pays-Bas [1925] *44,* pp. 487 and 496 [apparatus] and p. 549 [author's results]) to show that silver is deposited directly from such solutions. It was found that silver is deposited readily at low potentials, such as –0.25 volt, whilst the alkali metal was not deposited until its usual deposition potential of –2.0 volts was reached. This result shows the "replacement theory" to be untenable and, as stated in Blum and Hogaboom ("Principles of Electroplating and Electroforming," 1930 Ed., p. 97) since "there is no conclusive evidence to show that the metal is deposited by secondary reaction . . . such an explanation complicates, instead of simplifying, the process."

The newer theory, though simpler than the older one, does not explain satisfactorily all the known experimental facts, and much work remains to be done before a complete theory of the mechanism of metal deposition from double cyanide solutions can be given. Although not complete, the above theory gives some picture of the reactions taking place in the double cyanide solution and shows that since the K^+ or the Na^+ ions are not directly concerned in the deposition of the silver (as they are in the "replacement theory") there should be little difference in the silver obtained from potassium or sodium cyanide solutions. This, however, is a matter upon which there is still a great difference of opinion.

Silver Researches and Their Results:

When the effect on the deposit of various factors was studied, it was found that carbonate and free cyanide materially affected the hardness of the deposit. Increase in carbonate content, up to saturation, was found to decrease progressively the hardness of the deposit. Increasing the free cyanide content was found to give the same result up to about 200% excess free cyanide, after which the deposits became harder, reaching an approximately constant hardness above 400% excess cyanide when a bluish, "zincy" deposit was obtained. This deposit was very easily polished. Other substances, e. g. phosphates, sulphate, borates, chlorides, were found to make the deposits generally patchy and relatively hard. The presence of chloride (in 1.25 *N.* strength) particularly was found to give rise to hard and unsuitable deposits.

Current density was found to have little effect on the hardness of the deposits. The deposits became slightly harder up to 2.5

amps/sq.ft., after which they became softer again. With suitable agitation, good deposits were obtained at current densities up to 10 amps/sq.ft. with warm solutions and good agitation, higher current densities than this, up to 15 amps/sq.ft., are being used commercially (see F. Mesle, Monthly Review, Vol. 15, November, 1928).

It is generally agreed that, as shown by the above results, the presence of a certain amount of carbonate is beneficial in a silver plating solution. It increases the conductivity, thereby increasing the throwing power, and gives rise to smooth, soft deposits. However, for the best results to be given, the free cyanide in the solution should be proportional to the amount of carbonate present. In a solution with little or no carbonate a 50% excess of cyanide is ample, whilst when the carbonate reaches about 12.5 ounces K_2CO_3/gal. (or 9.6 ounces Na_2CO_3) 90-100% excess cyanide should be used.

The effect of carbonate and of free cyanide on the anode must also be considered. High carbonate content in the presence of insufficient free cyanide is likely to cause anode trouble, just as will too high a percentage of free cyanide.

Potassium and Sodium Cyanides:

Much discussion has taken place over the supposed inferiority of sodium cyanide for silver plating. In an attempt to obtain some information on the subject, a silver solution was made up from potassium cyanide and the loss in free cyanide (due to its conversion to carbonate) replaced by sodium cyanide. Deposits were taken in the various solutions so obtained and their hardness determined. No bad effect due to the presence of sodium cyanide in the solution was noticed, either in the hardness and regularity of the deposit or in the behavior of the anodes.

As an extension of this work, 24 nickel silver spoons were plated in trade solutions under trade conditions, some in sodium cyanide solutions and some in potassium cyanide solutions. Whilst slight differences existed between individual spoons, due to differences in plating conditions and in solution composition (eight different solutions were used) the finishers who polished the spoons could not detect any difference between the two sets of spoons, nor could the two sets be picked out before or after finishing. The results led to the conclusion that there is very little difference between the silver deposited from the two types of solution, and that

potassium cyanide showed no marked superiority over the sodium salt.

Solutions of potassium salts have greater conductivities than equivalent solutions of sodium salts, but this is only likely to prove an advantage when high current densities are being used, necessitating the carrying of a large current by the solution. The conductivity of a typical silver plating solution, containing 3 troy ounces/gallon of silver, 50-100% excess cyanide, and containing carbonate, worked at a representative current density and with the normal agitation of the cathode rod, is adequate whether the solution is made from potassium or from sodium cyanide. Finally it should be mentioned that it is the silver ion concentration of the solution which determines the limiting current density which can be used, under given conditions, for 100% cathode efficiency, and not, as is frequently thought, the conductivity of the solution.

The solubility of sodium carbonate is much less than that of potassium carbonate, but no trouble is likely to be caused by the crystallization of sodium carbonate unless the solution is very high in carbonate and is subjected to severe cold.

One cause of disappointing results with sodium cyanide has doubtless been the failure to recognize that when the sodium salt is used, *less* (roughly only four-fifths of the weight) should be employed than when the potassium salt is used. (See Blum and Hogaboom, 1930 Ed., p. 220.) Further, the use of impure sodium cyanide, i. e., sodium cyanide to which sodium carbonate or chloride has been added to make it weight for weight equal in cyanide content to pure potassium cyanide, can cause trouble by causing the accumulation of undesirable salts, e. g., chlorides, in the plating solution. Only pure sodium cyanide—the so-called "sodium cyanide, 130%"—should be used in the plating solution.

Results and Theory:

The results described are not inconsistent with the theory outlined above. The alkali metal ion will be attracted to the cathode, although it will not be discharged, and will have with it an equivalent amount of anion, e. g., CO_3--, SO_4--, that is, there will be an accumulation of alkali salt around the cathode, so that the environment in which the deposited silver crystals grow will be different when different salts are present. Thus, it might be expected that the addition of different salts to the silver solution would cause differences in the deposits, and also that the same anion would have

the same effect in a sodium cyanide solution as in a potassium cyanide solution. These predictions were confirmed by the experimental results. It was found that the cathode polarization was influenced mainly by the alkali metal ion present, whilst the deposit was influenced by the anion which had been added to the plating solution.

Convention News

The Rochester Branch of the Electro-Platers Society is well under way with the plans for the coming Convention to be held in Rochester from June 29th to July 2nd, 1931.

We hope this will be the largest and best Convention ever held by this Society. We are planning on having a large exhibit of finished products.

All those intending to exhibit kindly correspond with

MR. HARRY PUFFER,
56 Catalpa Road, Rochester, N. Y.

T. C. KOHLMEIER, *Chairman.*

SIMPLIFIED METHODS OF CHEMICAL CONTROL, by L. C. Pan, Ch.E., Ph.D., Instructor of Electroplating, The College of the City of New York. $3.25 postage prepaid. 11 x 8½. Including 22 charts with explanatory text covering all plating solutions; viz., gold, silver, nickel, copper, zinc, cadmium and chromium. It is especially valuable to chrome platers. With these charts you can eliminate the long calculations with figures, also shorten and simply the control of your plating solutions.

The book is published by the New York Branch, John E. Sterling, secretary, 2581 46th St., Astoria, L. I., N. Y., and sold only to members of the American Electroplaters' Society. Your secretary has a copy which you may examine at your branch meeting.

REPORT OF THE EDUCATIONAL BUREAU

In our efforts to get an Educational Bureau to function as recommended by the Washington 1930 Convention, we tried to get the branches to appoint a representative on this Bureau and found that only 14 branches out of 27 branches responded and answered the questionnaires sent out by the chairman of the Bureau, and only two branches (Detroit and Philadelphia) responded with any kind of a plan as to what is required to start an educational program, and while a list of speakers was listed from several branches, they did not specify any subject these speakers would talk on, or when and where they would be available.

Now to get these properly compiled we have organized the Educational Committee into some tangible form so that the branches can be helped to function as the delegates to the 1930 convention at Washington desired they should, we have arranged the branches into 9 districts as follows:

DISTRICT 1

St. Louis, Indianapolis, Anderson, Cincinnati and Dayton Branches.

DISTRICT 2

Chicago, Milwaukee and Grand Rapids Branches.

DISTRICT 3

Detroit, Toledo, Cleveland and Pittsburgh Branches.

DISTRICT 4

Toronto and Montreal Branches.

DISTRICT 5

New York, Newark, Philadelphia and Baltimore-Washington Branches.

DISTRICT 6

Rochester Branch.

DISTRICT 7

Boston, Worcester and Providence-Attleboro Branches.

DISTRICT 8

Bridgeport, Waterbury and Hartford-Connecticut Valley Branches.

DISTRICT 9

Los Angeles and San Francisco Branches.

In order to attain the best results of the work in these districts, the Supreme President is to appoint a chairman in each district, who will report to the chairman of the Supreme Society's Educational Bureau.

These district chairmen can then call a meeting of the branch representatives in their district and formulate plans that will function in their respective district.

Any branch may call upon the district chairman to help and arrange for a meeting or speaker, and also to assist in making arrangements for a class, and if necessary the chairman may make a trip to that branch and his mileage for this trip is to be paid by the Supreme Society, his hotel expenses to be paid by the branch calling him, or all the branches in his district can create a fund for this purpose.

The district chairman shall make a report each month to the Supreme Educational Bureau chairman, who in return will report the same in the MONTHLY REVIEW, so that all the members will be able to note the progress being made each month.

Each district chairman can also keep a list of subjects and also of speakers in his district, and when and where they will be available, so that branches in his district can have a subject for any meeting.

Suggestions to District Chairman:

Have each branch in your district appoint or elect a representative on the Educational Bureau, and also an Educational Committee of each branch, who in turn should visit the local Board of Education or other proper authorities to secure a place where a laboratory can be maintained. Vocational, Trade or High Schools seem best suited for the purpose.

Things your local Board of Education or other authorities will want to know:

What will the average attendance be?

How many nights the class will meet?

Who will instruct the class?

What kind of instruction necessary?

Equipment and supplies other than that which they have on hand?

It would be well to have the above details attended to before visiting the above authorities.

Usually an instructor can be obtained from your branch membership, salary to be paid by the Board of Education.

If necessary the initial supplies and equipment could be paid for out of the branch treasury and maintained afterward by the Board of Education.

In some localities they have an advanced class for Foreman Platers and an elementary class which takes care of the assistants and those who are not members of the Society.

With the slogan of Drs. Blum and Graham,

"A class in every branch ever in our minds"

Yours respectfully,

ALBERT HIRSCH, *Chairman,*
Educational Bureau.

THE NEWARK BRANCH

takes pleasure in extending a cordial invitation
to all members, their friends and others
interested in the art of electroplating
to attend their

Thirteenth Annual Banquet

TO BE HELD AT

the Elk's Club, Broad St., Newark

On Saturday, April 11, 1931, at 7 p.m.

Educational Session at 2:30 p.m.

Mr. Philip Sievering will preside. Papers relating to the plating industry will be read and discussed.

GEORGE REUTER,
Secretary Newark Branch.

A. E. S. PAGE

We are pleased to note how seriously some people take their REVIEW. We have had a great number of letters from our members complaining about not receiving their copies on time, some not having had THE REVIEW for months. Well, there are a number of reasons why most people lose the contact, as, for instance, they move and do not notify the proper authorities of their new address, with the result that THE REVIEW comes back to the Springfield Post Office marked "No such number," "Unclaimed," "Moved," "Left no address," etc. Return postage is charged to Mr. Gilbertson, our Secretary-Treasurer, and amounts to considerable during the year. A little thought on the part of our readers who contemplate a change of address will go a long way towards keeping you in touch with the doings of the A. E. S. through the medium of THE MONTHLY REVIEW.

* * *

A good friend from Detroit and a sincere worker in the A. E. S. sent a letter to us last week, part of which we quote: "I've read the whole number with much pleasure, and especially the reports of the 'few' branches that have sent them in. There were 10 in the February issue, and I notice there are twenty-five branches listed on the last page. What about the other fifteen? Isn't there something we can do to impress upon the other fifteen to get in their reports so that we can all read them and get some good out of them?" You are right, brother, the great majority of our membership would be pleased to have the chords that are broken vibrate once more.

* * *

Those who were privileged to attend the educational meeting of Chicago Branch in January could not help being impressed with the type of men who are leading us onward. Dr. Blum and Dr. Watts were at their best, and as usual kept the interest of everyone present.

Mr. Clindinin, speaking on low pH nickel, was bombarded with questions for almost an hour after his paper was read, showing the interest in this type of solution.

Mr. Soderberg and Mr. Haefer came next, the former speaking on rust preventives, and the latter on brighteners.

Mr. J. J. Mulligan, Supt. U. S. S. Lead Refining Inc., put the finishing touches on with an address entitled "Practical use of the electro motive series in electro deposition and separation of metals." All in all it was a great session.

* * *

When a bit of sunshine hits ye
After passing of a cloud,
When a bit of laughter gits ye,
And yer spine is feelin' proud,
Don't forget to up and fling it
At a soul that's feelin' blue,
For the minit that ye sling it
It's a boomerang for you.
—*Capt. Jack Crawford.*

PRESIDENT'S LETTER

In January your President had the good fortune of being able to attend the Research Conference which was scheduled to take place in conjunction with the Chicago Branch's Yearly Meeting and Banquet.

All the members of the Executive Board and the Research Committee were present with the exception of Mr. Wm. Guilfoile of Waterbury, who was sorry to report he could not get away from his work just at that time.

The Executive Board and the committees were kept busy, as meetings were held from Friday morning, January 16, 10 a.m., until Sunday, January 18, at noon, and I compliment all the officers and the committees for their faithful attendance.

Dr. Blum deserves all the credit for the work done in getting these committees together, and for the efficient way of arranging the work to be done.

Chairman Hay of the Research Committee has proven he is the right man in the right place, by keeping the good work of his predecessors intact and improving on the same this year, and I know his committee is making great strides for the future.

I will not attempt to go into details of these meetings, as they will be published in full in the MONTHLY REVIEW.

This meeting in Chicago will mark one of the largest strides made in the history of the Society, and should be productive of good results in the way of establishing American Electro-platers' Society standards, which will be of mutual benefit to the consumer, manufacturer, and the foreman platers.

It is very gratifying to note that other societies are considering meeting with our Society, and the same will have to be encouraged by the committees of our Society doing all that is expected of them, and it will not be many years before our Society will be rated as one of the foremost educational societies in the country.

The Educational Committee has met with quite some difficulties in getting organized, and the same was to be expected, for if this was such an easy matter it would have been accomplished long

before this, as provision for the same has been in the constitution for many years.

We are having very encouraging prospects ahead, and the following report which was endorsed by the Executive Board at the Chicago meeting is being put into effect at once, and I am appointing chairmen of the districts and the same will appear in the April REVIEW.

These district chairmen will, according to the views of the members in their district, be able to form a concrete plan, as to speakers, lectures, and instructions best suited to the membership in each district, and they will have the use of the experiences gained in all the other districts, by the reports printed in the MONTHLY REVIEW as the Supreme Society Chairman receives them.

A meeting of all the district chairmen should be also arranged for at the Annual Convention each year.

GEO. GEHLING, *President.*

DETROIT BRANCH

The February meeting of Detroit Branch was held in Hotel Statler on February 6. Mr. Soderberg gave a very interesting address, in which he described the proceedings of the Research Committee meeting in Chicago, and also told us of the efforts of the A. S. T. M. in trying, in conjunction with the A. E. S., to standardize electro-deposited protective coatings. Mr. Soderberg's address was very interesting, and gave our members information on the various activities of our Society.

The Question Box brought out the following

Question—What is the advantage of a cyanide plus acid copper against a deposit of cyanide copper alone?

Answer—The advantage of low cost and more easily buffed.

Question—What relation, if any, have you experienced with agitation as regards pitting?

Answer—Agitation of solutions especially with air is only liable to cause porosity—due to sediment lodging on the surface of the work, and also due to contamination of the solution from bacteria in the air. In the case of mechanical agitation of the work any pitting which occurs is usually due to the condition of the solution, and is not affected either favorably or unfavorably by the agitation.

The annual Educational Meeting and Dinner of Detroit Branch will take place on Saturday evening, March 14 next, at Hotel Fort Shelby. An interesting and instructive program is arranged and a cordial invitation to attend is given to all platers and those interested in the finishing of metals. Detroit Branch gives the assurance that the evening will prove to be one of pleasure and profit to all who attend.

CHAS. M. PHILLIPS, *Secretary and Treasurer.*

LOS ANGELES BRANCH

The Los Angeles Branch held its regular monthly meeting as usual on the second Wednesday, January 14, at the Pig 'n Whistle, with President E. W. Francis in the chair; thirty-six attending.

Minutes of the previous meeting were read and accepted. Bills ordered paid and communications read and filed. Two applications were read and turned over to the Board of Managers for investigation. One applicant, E. J. Wright of Hamilton, New South Wales, Australia, was voted to the Los Angeles Branch, but was absent on account of the great distance.

The members voted to hold their annual educational session and banquet on Saturday, March 14, which undoubtedly will be the biggest affair yet. The committee has selected the Chamber of Commerce Building as the headquarters for this and future occasions. Our February 11th meeting and future meetings will also be held there as usual on the second Wednesday of each month.

A very interesting letter was read by the Secretary from Jacob Hay, chairman of the Research Committee, regarding the Chicago meeting of American Society of Testing Materials. Mr. Hay mentioned the fact that time is come for the American Electroplaters' Society to find out what constitutes a good electroplated deposit. We agreed with Mr. Hay, but on the other hand we can't find the manufacturer who is willing to pay for a good electroplated deposit.

Following this duscission the Branch voted to donate $50 to the Research Fund. Secretary Rynkofs outlined the good of the chemistry class and what it has done for the members of this branch who attend.

Mr. M. McNulty read a paper on "Gold Plating by R. Gripp."

Mr. R. Gripp, librarian, found the following questions in the box:

Question—What is a good stopping off varnish?

Answer—Use red chrome lacquer.

Question—Why does an acid copper solution work irregular when the solution is strong above 27 degrees Baume?

Answer—Bring solution down to 18 degrees by adding water.

Question—When a nickel solution is too hard and is inclined to burn on the ends before the center plates heavy, what is the best thing to add to soften it? Solution is composed of both double and single nickel salts, mostly single.

Answer—Add conducting salts in the form of Epsom salts and Boric acid.

Question—Will sodium-perborate stop pitting in a nickel solution?

Answer—Yes, about 8 oz. to 50 gallons of solution dissolved in hot water.

Question—How can you nickel and chrome plate aluminum?

Answer—Dr. Work's paper read by Ben Foss.

The meeting adjourned at 10:15.

M. D. RYNKOFS, *Secretary-Treasurer.*

CHICAGO BRANCH

The regular monthly meeting of Chicago Branch, A. E. S., was held Saturday, February 14, at the Atlantic Hotel.

The meeting was called to order with Vice-President J. J. Witte presiding and all officers present excepting President S. J. C. Trapp.

Mr. Robert Meyers, chairman of the Banquet Committee, read a report on the Banquet. This was not one of the largest banquets ever held, but one of the best. There were 278 dinners served.

The educational session was presided over by our Librarian, Mr. O. E. Servis, and the following papers were read:

"Rust and Rust Prevention," Gustaf Soderberg, Udelyte Process Co., Detroit, Mich.

"Practical Use of the Electro-Motive Series in Electro Deposition and Separation of Metals," John J. Mulligan, Supt. U. S. S. Lead Refinery, East Chicago, Ind.

"Production Nickel Plating at Low pH," C. E. Clindinin, General Spring and Bumper Corp., Chicago, Ill.

"The Use of Brighteners in Plating Solutions," J. H. Hoefer, Crown Rheostat and Supply Co., Chicago, Ill.

This was a very good program and 330 were in attendance.

On February 2, Chicago Branch Educational Committee met for the purpose of formulating a definite arrangement to start the chemistry class work.

After hearing the report of Mr. H. W. Faint on the arrangements that he had been able to make with the Chicago School System for the use of a laboratory, it was decided that on account of High School Evening Courses closing on March 15th, a substitute course be arranged for the entire membership in the form of a lecture course. This Mr. Faint volunteered to offer. The lectures would be held between the hours of seven and eight on the meeting night of the regular branch meeting until fall. It was then decided to proceed with the laboratory work at Lane Technical High School.

This laboratory course is to run for eight weeks, terminating the latter part of November.

The lectures to be given before the regular branch meeting convenes will be as follows:

1st: Importance of current densities in electroplating anode and cathode efficiencies.

2nd: Colloids as they affect plating solutions.

3rd: Effect of impurities in plating solutions.

Calculations: Tank capacities, buss bar capacities, commuting area of articles to be plated.

The meeting was then turned over to the Librarian, and the following questions were found in the box:

Question—Is there an insulation for wooden tanks that will stand up with a hot hydrochloric acid sol.?

Answer—It was thought not, but a tank made of cypress wood and put together with monel metal bolts and nuts would last a long time.

Question—How can lead be stripped from sheet copper?

Answer—Use a concentrated hydrochloric acid sol. and agitate.

Question—What per cent of nickel cyanide can be added to a silver sol. and still give a soft deposit?

Answer—About 5% of the weight of silver cyanide was suggested, but up to 25% could be used for special purposes.

Question—What is a good formula for a gray finish on steel? Must not show any bluish tinge.

Answer—It was suggested to make up an acid arsenic sol. muriatic acid 1 gal., white powdered arsenic 12 oz., carbonate of iron 12 oz., water 2 qts. Try this as a dip. If the proper color is not obtained try electric current. Use carbon or nickel anodes, normal temperature.

Question—Wanted, a formula for rhodium plating sol. What is average amperes used per square foot? Is it used hot or cold?

Answer—The formula for rhodium plating is covered by patent. Thirty to 35 amperes are used per square foot. The sol. is used hot.

Question—How many ampere minutes are required to plate .001 in. chromium?

Answer—It was suggested that at approximately 15% efficiency about 18,000 ampere minutes would be required.

J. C. KRETSCHMER, *Secretary.*

OBITUARY

We regret to learn that an old friend of the A. E. S. has passed away.

Mr. A. W. Storms
of Santa Monica, California

was for many years Chicago manager of the Hanson-Van Winkle Co. He was one of the founders of Chicago Branch and did a great deal towards its successful inception. The members of Chicago Branch wish to extend to Mrs. Storms their sincere sympathy in the loss of her husband.

PROVIDENCE-ATTLEBORO BRANCH

Meeting January 23, 1931. Arrangements were made so that everyone who wanted to could have supper at "Miss Dutton's." There were eight who came in.

After supper we proceeded to the rooms, and President Chace introduced the speaker. Mr. Hogaboom said he would offer a few remarks before putting on the pictures, part of which follows:

A common trouble with a great many platers is that they undertake to produce a plating solution without understanding the scientific principles of the ingredients in the composition.

E. g. the Tainter process at Wallace, Idaho. Mr. Tainter stated that they were losing more than $10,000 per week on investigation. They found the trouble was due to there being a small amount of germanium in the composition, proving that a very small amount of impurity will sometimes cause immense trouble.

Anode efficiency is often incorrectly defined, i. e., the net amount of metal that goes into solution is not properly checked. In one case analysis of solution showed 90% zinc; high zinc content causes a pinkish deposit.

If solution contains

80% copper
20% zinc

anodes should be of same composition.

In regard to "conducting salts" he thought that it was more likely that their function was to keep the anode clean. In reference to analysis of solution, he said that in titrating they could not get the same results twice, until they found that carbonate affects the results when zinc is present, so they precipitated the carbonate with barium nitrate, and were then able to get uniform checks.

They tried amounts of carbonate from 2 to 32 ozs. until they found the proper amount.

Then we had the pictures.

In summing up Mr. Hogaboom said that the only ingredients necessary in a brass solution are the pro-amounts of copper and zinc cyanides with the addition of carbonate; in proof of which he said that he had run a larger solution continuously for one year without changing.

After a short question period and a rising vote of thanks, we adjourned.

There were 29 present—one from Boston.

JOHN ANDREWS, *Secretary*.

WATERBURY BRANCH

Considerable interest was manifested in the last meeting of Waterbury Branch, which was presided over by Vice-President Barrie A. Hackett. The speaker of the evening was Ray O'Connor, vice-president of the A. E. S., and former chairman of the Research Committee. Although given but short

notice in which to prepare his remarks, Mr. O'Connor delivered an address that was interesting and instructive from start to finish. Taking for his subject "The Activities and Plans of the Research Committee," the speaker told of the work done since the Montreal Convention, up to and including the recent conference held in Chicago last month. In concluding his remarks, Mr. O'Connor called attention to the return postal cards that had been sent out some time ago, asking for information relative to the name of the firm and the proper person to be addressed in the soliciting of funds. Suggested that if no action had been taken in the matter it should be looked after at once. A rising vote of thanks was extended the speaker for his remarks. Favorable action was taken on the application of Louis Edgar Longee, chemist, Scovill Mfg. Co., for associate membership. The subject of "rust proofing" in its various forms was discussed by several of the members. A short discussion led by Andrew Perrin on the subject of "spotting out" concluded the meeting.

W. F. GUILFOILE, *Secretary.*

ST. LOUIS BRANCH

Regular meeting of St. Louis Branch, A. E. S., was held at the La Salco Co. plant Friday, January 9, 1931, and called to order by President Rufling. Minutes of last meeting read and approved. Banquet Committee made a report and stated that everything was ready for the big event.

Dr. Stout then was called on, and he gave us a demonstration on how to analyze copper solution, to find the amount of free cyanide and copper, and then explained same, which was very interesting. Everyone enjoyed it very much. Questions were asked and discussed.

Mr. Williams made report on the afternoon session of our Banquet, and gave Dr. Stout, of Washington U., the credit of putting it over in grand style. In making simple demonstrations of analysis of nickel solution and how to make a color test. After which questions were asked that brought out a lot of discussion. Mr. Proctor made a few remarks. Session was then closed to get ready for the dinner and dance.

Mr. Musick was in charge of the banquet and he sure put it over. There were no speeches made, but a lot of entertainment. Mr. H. J. Richards recited a poem on "The Cause of Depression," which was very good. Mr. R. Huzuka of Chicago Branch entertained us with a song. Thanks, Rudy, always glad to have you with us. The tables were then cleared out and the dance took place, and when the band played "Home, Sweet Home," everyone said they had a very good time.

CHAS. T. MCGINLEY, *Secretary.*

NEW YORK BRANCH

The regular meeting of the New York Branch was held at World Building, Park Row, February 13, 1931. Vice-President R. Ligori presided. Report of the Banquet Committee was given by Joe Musante and reported favorably.

The librarian stated he still has some surplus copies of Dr. Pan's charts. Any member who desires a copy communicate with H. Levine, librarian. As there was no further business, the chair was turned over to the librarian under good and welfare.

Question—How to chrome plate on glass.

Answer—Paint on with silver, heat treated, then prepare for chrome plate.

Secretary Sterling read an article on hot nickel use by the U. S. Government, by Prof. Baker. Nickel sulphate 32 ozs., nickel chloride 2 ozs., Boric acid, 4 ozs., then later increased to nickel sulphate 3 lbs., nickel chloride 3 ozs., Boric acid 2 ozs. Temperature 125 to 140° F. cathode agitation. The increased temperature and vertical cathode agitation liberates hydrogen which would otherwise deposit with the nickel.

Meeting adjourned at 11 o'clock.

HARRY SIMON, *Recording Secretary.*

The regular meeting of New York Branch, A. E. S., was held at World Building, Park Row, January 23, 1931—President Haushalter presiding. It was decided the Banquet Committee go into session, while the other members take up the matter of good and welfare.

Question—Am using the bright alloy solution (cadmium and zinc). Found it hard to maintain and plate bright continually.

Answer—Use zinc anodes and add a little HgO mercuric oxide.

Question—The best method to clean Al. castings for Ni?

Answer—Look up Dr. Work's method. Write to the Aluminum Co. of America.

Question—How to rack and wire properly work that is dipped in HF solution, as the copper hooks deteriorates the acid and deposits itself on the work.

Answer—Lead plate the hooks and racks to prevent the copper dissolving in the hydrofluoric acid.

Suggestion by Librarian Levine, the best method to remove Zn, from a Ni solution, that is used for die casting, each morning to put a bar of metal in the bath, strike for 2 min., at 10 volts, then reduce current and let run till bar plates a gray white deposit of nickel.

Meeting adjourned at 11 o'clock.

HARRY SIMON, *Recording Secretary.*

ROCHESTER BRANCH

Rochester Branch held their monthly meeting at the Hotel Seneca on Friday evening, January 16. President Reama was in the chair.

There was a very good attendance. Among them was Mr. R. K. Hutchings.

It is good to see our older members coming to the meetings, as it shows they are interested in the coming convention at Rochester in June.

One new member was elected, Mr. H. A. Gulbrandsen, who is employed by Metal Art Co. at Rochester, N. Y.

We expected to have an open meeting and smoker. Mr. George Hogaboom was to have given a talk on hot nickel solutions, but he was unable to be present. But Mr. Wm. Hart made a motion, which was seconded by Mr. J. R. Elster, that we adjourn to the home of one of our new members, Mr. Fred Glitzer, and finish our meeting there. The motion was carried by a rising vote. Mr. Glitzer sure knows the word hospitality. Our well-known quartet, Messrs. Hehr, Lux, Reama and Elster, rendered some of the latest song hits. Mr. Kohlmeier, with the assistance of Mr. Hart, sang "What Are We Going to Have Tomorrow?" It sure was a hit. Mr. Gartland gave an Irish jig. Rochester Branch sure has talent.

On Saturday evening, January 31, the boys and their friends enjoyed a bowling party and buffet lunch at Muh's alleys. A good crowd was out and all enjoyed the evening.

The convention committees are all at work, so remember Rochester, June 29 to July 2, 1931.

CHAS. GRIFFIN, *Secretary.*

CONVENTION NOTES

To the Editor of the Monthly Review:

The chairmen of the various committees for the Convention of Electroplaters' Society held a meeting at the Hotel Seneca, Rochester, New York, on Tuesday evening, February 10, to discuss progress on the plans for this affair to be held at the above mentioned hotel from June 29 to July 2, 1931.

The reports were very encouraging to the general chairman, Mr. S. P. Gartland.

The chairman of the Entertainment Committee promises that any one who misses this convention will regret it.

The chairman on papers also stated there will be many new problems brought forth and clarified.

You cannot afford to miss this convention, not only for the knowledge to be gained but also for the good time to be had.

Don't forget the exhibits; correspond with H. W. Puffer. His address is 126 Catalpa Road, Rochester, New York.

F. J. KOHLMEIER, *Chairman of Publicity Committee.*

PHILADELPHIA BRANCH

Philadelphia Branch held its regular monthly meeting Friday evening, February 6, 1931, with President Lunbeck presiding.

The President announced the death of Wm. P. Scott, chairman of the

Board of Managers. A. M. Robson was appointed to fill the vacancy caused by Mr. Scott's death.

After our regular order of business, Lieut. A. Willink of the Frankford Arsenal, Philadelphia, spoke on the chrome plating of gauges at high temperature and high current densities, and at the conclusion of his remarks was given a rising vote of thanks. The application of Carl Swartz of Allentown, Pa., was received and referred to the Board of Managers for investigation.

JOSEPH E. UNDERWOOD, *Secretary.*

ANDERSON BRANCH

The meeting of the Anderson Branch, A. E. S., was called to order by Mr. Cleaver at 7:45 p.m., January 19, 1931, in the Men's Assembly Room of the Anderson Y. M. C. A. Twenty-eight members and guests were present.

Roll call of officers showed Mr. Phelps absent.

Minutes of the last previous meeting, January 5, 1931, were read by the secretary and approved by the Branch. Two communications from the supreme body were read. Reporting for the Membership Committee, Mr. Onksen stated that the committee had deferred action until after the open meeting of January 19, in order that guests at that meeting might be included in the list of prospective members.

There being no further business to dispose of, the meeting was turned over to Dr. Cotton, who discussed the first part of his text on the elements of electroplating. An outline of his lecture is attached hereto.

Following this, Dr. Cotton answered such questions as were raised by members of the Branch, and the remainder of the time was devoted to a discussion of questions from the Question Box.

Mr. Castell summarized a recent article, by L. C. Pan in "Metal Cleaning and Finishing," in answer to the first question, which dealt with the effect of carbonates and of sodium thiosulphate in cyanide copper baths.

The question of advantages of a high density solution for chromium plating precipitated a heated general discussion. Advantages of this type of solution as presented by various members were as follows:

1. Better throwing power in presence of large amount of iron, as in old solutions.
2. Less rigid control of sulphate ratio required.

Mr. Onksen raised the question of the practicability of control of chromium plating solutions by a hydrometer in absence of laboratory methods. This was not considered a sufficiently accurate method for any except new solutions.

The remaining questions were held over until the next meeting, due to the late hour.

Motion for adjournment was carried at 10:00 p.m.

F. M. WAGNER, *Secretary-Treasurer.*

HARTFORD-CONNECTICUT VALLEY BRANCH

The Hartford-Connecticut Valley Branch held its regular monthly meeting on January 26, at the Hartford Chamber of Commerce, 805 Main Street, Hartford, Connecticut.

The meeting was called to order at 8:30 p.m. with President Beloin in the chair. Minutes of the previous meeting were read and approved. All communications were read and placed on file. No bills were presented. The resignation of Mr. Geo. W. Grandquist was received and read. It was voted to accept his resignation, although we are sorry to lose him as one of our active members.

At the meeting the question of a banquet was brought up, and it was voted to hold this over until our next meeting.

At the conclusion of our regular business, Mr. B. Brooks, chief process engineer of the Chance-Vought Corporation of East Hartford, Conn., gave a very interesting talk on "The Anodic Treatment of Aluminum and Duraluminum." His talk was of much interest, due to the fact that it is a comparatively new development. He had some samples of the metals after they had received this anodic treatment. Mr. Brooks, being a licensed pilot, was able to give us some very interesting facts in connection with general aircraft procedure. In conclusion he was given a rising vote of thanks.

The meeting was attended by twelve members and visitors, and was adjourned at 10:00 p.m.

V. E. GRANT, *Secretary.*

BOSTON BRANCH

Boston Branch held its regular meeting Thursday, the 5th, at the American House with fifteen members present.

One application was received and was referred to the board of managers.

Now that the chemistry class is going along, our librarian will start making arrangements for speakers at our future meetings.

We had with us a speaker for the evening, Mr. Casell of the Udylite Process Co., who spoke on the protection of metals from rust by cadmium plating. He also told of the tests made after plating and how the work is done. A vote of thanks was given Mr. Casell for his interesting talk.

We had with us Mr. Frank Clark, who will give the Branch a talk at a later date.

The chemistry class of the branch is going along fine with twenty members, and every one is going to it for all he is worth. The class meets one evening a week. One week it is lectures, and the next week it is laboratory work. Each man brings his own solutions. They have been working on the nickel solution, and now every man knows how to analyze his solution for the metal contents, and also the chlorides and ammonia contents.

The next lesson of the class will be the cyanide copper solution. The members are learning fast and think that it is very interesting, and expect

to continue this class each year. Our instructor thinks that the class is doing very well and hopes that they will stick to it.

This Branch expects to hold open meetings again for another membership drive so that when the class starts again in the fall for its second year it will have a larger class.

This chemistry class has adopted a motto. It is: "Everybody learn to analyze his own solutions."

The meeting adjourned at 11:30 p.m.

PLATERS CLASS

The Boston Branch of the American Electroplaters' Society has organized a class in electroplating and principles of chemistry that bids fair to be one of the most enthusiastic class of students in the Society.

A committee was appointed early in the year. Considerable time was spent in the investigation of methods of the instruction in the various branches and facilities for proper instruction. After much consideration a laboratory in the Coyne Engineering School was obtained, chemical equipment bought, and Mr. William Cahill secured as instructor.

Mr. Cahill has been instructor of chemistry at Holy Cross College and has had much practical experience.

Largely through the personal efforts of Mr. Charles F. Campbell, president of the Boston Nickel Plating Co. of Boston, Mass., and Mr. Bart Lee of the Boston Platers' Supply Co., also of Boston, who have given freely of their time.

The turnout for the class has been over twenty, and has shown an increase at each class meeting.

The officers of the Branch are very much pleased with this showing, and feel that the result will be a credit to the Branch, to the Society, and the industry as a whole.

Yours very truly,

A. W. GARRETT, *Secretary.*

CLEVELAND BRANCH

Cleveland Branch held its regular monthly meeting on Saturday evening, February 7—President E. Steen Thompson presiding.

Mr. Singler, chairman of the Entertainment Committee, gave a report on plans for our March meeting.

A motion was carried that the report be accepted.

The Branch will hold an open meeting inviting all platers, their families, and friends.

Our President, Mr. Thompson, will give a stereopticon lecture, and refreshments will be served. Tickets will be 50 cents.

Our Librarian read a paper on "Production in Gold Plating." Some of the members gave their experience in connection with this work.

President Thompson then demonstrated the following method of cleaner control.

Solutions are: 9.8 cc of sulphuric acid to liter of H_2O, methyl red 5 grams to 50 cc of alcohol + 50 cc of H_2O. Make up regular cleaner computing total number of ozs. used. After cleaner has boiled well, pipette 1 cc, dilute to 100 cc with distilled H_2O. Add 5 drops of indicator. Add with dropper acid sol., counting drops, until just pink.

Ozs. of cleaner ÷ drops of acid used = value of each drop in ozs. of cleaner.

When cleaner weakens proceed as above. Subtract the number of drops of acid used the second time from those used the first time. This gives the number of ozs. of cleaner needed to bring it up to original strength.

With Vice-President H. J. TerDoest in the chair a rising vote of thanks was given President Thompson for his demonstration.

A motion to adjourn was carried at 10:45 p.m.

PAUL STAMM, *Secretary.*

PITTSBURGH BRANCH

We have two applications for associate membership as follows:

John Adam Bauer, 106 Liberty Ave., Pittsburgh, Pa.

George B. Svenson, 106 Liberty Ave., Pittsburgh, Pa.

Our meeting of Friday evening, February 6, was not very well attended. The officers went to much trouble in presenting a good program for their education and finished with a fine lunch. At one time, a lunch would do the trick in bringing most of the old boys out, but we think something else will have to be worked on them. I am in hopes that our next meeting will see more of them out. For one thing, spring will be with us, and a little fresh air will do us all good, so here's hoping.

S. E. HEDDEN, *Secretary-Treasurer.*

NEWARK BRANCH

The Newark Branch held its regular open monthly meeting at Franklin Hall, 41 Franklin St.

This being a social affair, there were no speakers present.

An evening of real enjoyment was given with Mr. Paul Oldham, our librarian, performing numerous amazing sleight of hand tricks.

Moving pictures of travel and educational value were shown.

Members and friends were served with refreshments.

The attendance was splendid, eighty-three members being present.

A card party and dance by Newark Branch will be held at Franklin Hall, Friday evening, March 6. Prizes for every table and for non-players also.

GEORGE REUTER, *Secretary.*

BRIDGEPORT BRANCH

Meeting called to order 8:15 p.m., Friday, January 9, 1931.
Roll call of officers. All present.
Minutes of last meeting accepted as read.

Committee Reports

Sick Committee reported that Bernie Moran was seriously ill at the Grace Hospital, New Haven, Conn., with a broken leg. The members of the Branch wish for his speedy recovery.

The Banquet Committee reports that a definite date has been set for the annual banquet. The annual banquet will be held on Saturday, March 21, 1931. The educational program will start at 2:00 p.m., with the banquet at 6:30. Further details regarding the banquet and educational program will be announced later. It was voted that the chairman of the Banquet Committee appoint a treasurer to handle all funds and pay bills contracted for the banquet, and to turn over any profit as a lump sum to the Branch Treasurer.

Chemistry Class Committeee reported that the class will start February 10 at Sterling Laboratory, Yale University. It was voted that the Treasurer of the Branch advance any member in good standing part of tuition fee up to the amount of $10.00. This was done so that any member could enter the class who desired to do so, but who was unable to pay entire tuition fee at once.

Communications accepted as read.

Quarterly report of Supreme Society read. Voted to be accepted as read.

The Treasurer was instructed to pay all bills outstanding.

Treasurer's report accepted as read.

Regular meeting adjourned early so that Banquet Committee could hold a gathering to arrange details for the annual banquet.

Meeting adojurned at 9:45 p.m.

APPLICATIONS

CLARENCE L. FOLTZ, 12 Ware Street, Dayton, Ohio.....Dayton
E. G. WRIGHT, c/o A. E. M. Company, Hamilton, N. S. W.....Los Angeles
CARL C. GREINER, 468 East 34th Street, Paterson, N. J. (Assoc.)....Newark
MR. THOMAS LYMAN, 18 Wadsworth St., Malden, Mass.....Boston
MAC. MUNNELL, 1188 Esperanza St., Los Angeles.....Los Angeles
GEO. W. DEMPSY, 830 W. 106th St., Los Angeles.....Los Angeles
JOHN ADAM BAUER (Asso.), 106 Liberty Ave., Pittsburgh, Pa.....Pittsburgh
GEO. B. SVENSON (Asso.), 106 Liberty Ave., Pittsburgh.....Pittsburgh

ELECTIONS

LEWIS E. ROSE, 1120 Taylor Street, Fort Wayne, Indiana.....Chicago
CLARENCE L. FOLTZ, 12 Ware Street, Dayton, Ohio.....Dayton
HERBERT A. GULBRANDSEN, 43 Shelter St., Rochester, N. Y.....Rochester
E. G. WRIGHT, c/o A. E. M. Co., Hamilton, N. S. W.....Los Angeles

SUSPENSIONS

THOMAS WISE, 766 Folkner Ave., Dayton, Ohio.....Dayton
EDWARD SUVERKROP, 640 W. State Street, Trenton, N. J.....Dayton

RESIGNATIONS

MR. ROSCOE RICE, c/o Hayes, Wheel & Forging Co., Chatham, Ont.....Detroit
WM. J. SPROULE, 6½ Holmes Street, Nashua, N. H.....Boston
GEO. W. GRANDQUIST, 34 Lyons Street, New Britain, Conn.....Hartford-Conn.

DEATHS

WM. P. SCOTT, 5422 Walnut Street, Philadelphia, Pa.....Philadelphia
C. BLETZ, Eagle House Hotel, Weston, Ontario.....Toronto

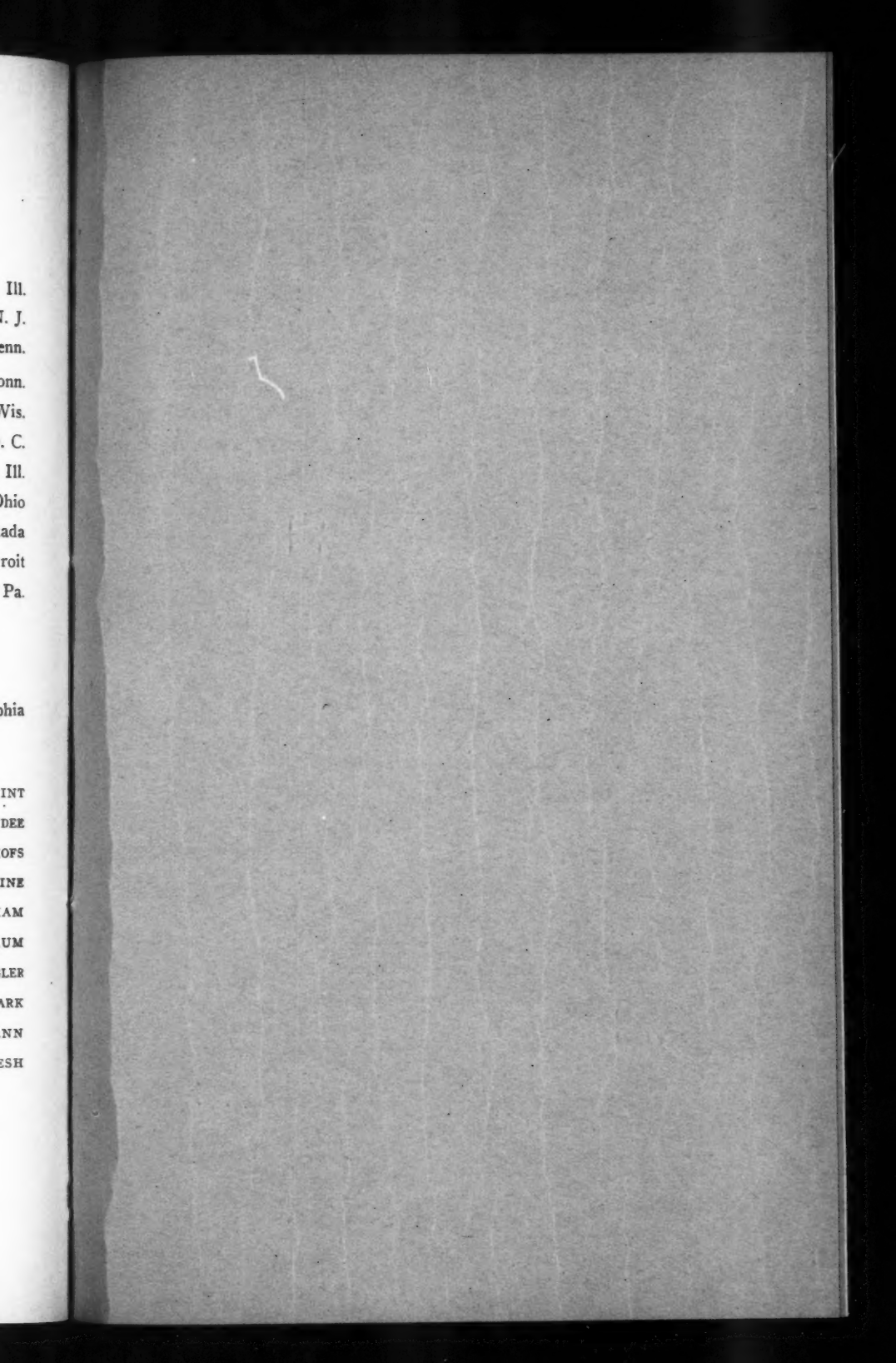
RESEARCH COMMITTEE

Chairman, JACOB HAY,.....6920 Ottawa Ave, Chicago, Ill.
Sec.-Treas., PHILIP SIEVERING,.....20 South Crescent, Maplewood, N. J.
S. E. HEDDEN, ...227 Fifth Ave., Aspinwall, Penn.
WILLIAM F. GUILFOILE, ...14 Oakland St., Waterbury, Conn.
DAN WITTIG,.....378 Third St., Milwaukee, Wis.
DR. WILLIAM BLUM,.....Bureau of Standards, Washington, D. C.
MR. OSCAR SERVIS,.....5305 Warner Ave., Chicago, Ill.
MR. N. E. ZADOWSKI,.....1383 W. 65th St., Cleveland, Ohio
MR. W. S. BARROWS, ...628 Dovercourt Road, Toronto, Canada
C. F. NIXON,.....Ternstedt Manufacturing Co., Detroit
DR. H. S. LUKENS,.....University of Pennsylvania, Philadelphia, Pa.

BUREAU OF EDUCATION

Chairman, MR. ALBERT HIRSCH,.....1945 Airdrie St., Philadelphia

Branch Representatives:

Chicago Branch.....HAROLD FAINT
Waterbury Branch.....ELLSWORTH CANDEE
Los Angeles Branch.....M. D. RYNKOFS
New York Branch.....HENRY LEVINE
Philadelphia Branch.....DR. A. K. GRAHAM
Baltimore-Washington Branch.....DR. WM. BLUM
Cleveland Branch.....J. C. SINGLER
Hartford-Connecticut Valley.....TENNANT ELWIN, FRANK J. CLARK
Worcester Branch.....M. H. FROMMANN
Toronto Branch.....C. KEMESH

Other Branch Representatives will be printed as received.